Rachel Carson National Wildlife Refuge

Wells, Maine

Annual Narrative

Calendar Year 2002

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

RACHEL CARSON NATIONAL WILDLIFE REFUGE

Wells, Maine

ANNUAL NARRATIVE REPORT

Calendar Year 2002

Refuge Manager — Date: Mar 24, 2003

Refuge Supervisor Review — Date: 2/30/03

Regional Office Approval — Date: 1/20/04

I. INTRODUCTION

Rachel Carson National Wildlife Refuge (RHC) is located along the southern coast of Maine in York and Cumberland Counties. The refuge's divisions stretch approximately 50 miles along the coast abutting the municipalities of Cape Elizabeth, Scarborough, Old Orchard Beach, Saco, Biddeford, Kennebunkport, Kennebunk, Wells, Ogunquit, York, and Kittery. According to year-end figures by the regional realty division, the refuge is approximately 5,142.51 acres.

The refuge, under the authority of the Migratory Bird Conservation Act, was established on December 16, 1966 as Coastal Maine National Wildlife Refuge to preserve migratory bird habitat and waterfowl migration routes associated with southern Maine's coastal estuaries. On June 27, 1970, the refuge was renamed in honor of world-renowned scientist and author Rachel Carson, who spent much of her life along the Maine coast.

Topography ranges from zero to 20 feet above mean sea level. Average slopes are between 0% over much of the marsh and beach areas to 20% where the wetlands give way to the sloped bank of the upland ridges and low hills. Major habitat types present on the refuge include barrier beach, coastal salt marsh, coastal meadow, forested wetland, upland forests, and grasslands.

Refuge and adjacent lands provide food and essential habitat for more than 250 species of birds. Those that migrate revitalize themselves on the refuge as they travel to and from northern breeding areas. Shorebirds are abundant during spring and fall migrations. Waterfowl are common year-round; black ducks, mallards, Canada geese, and common eiders are often found in marshes and waterways. Warblers, thrushes and other songbirds migrate through or stop to nest in the forests, fields and marshes of the refuge. Spring and fall provide excellent opportunities to see migrating birds of prey.

The refuge also supports many species of mammals, amphibians and reptiles. Fortunate visitors may see white-tailed deer, river otter, beaver, harbor seals, red fox, coyote, and the occasional moose on or near the refuge. Amphibians, such as spring peepers, wood frogs and tree frogs may be heard in the spring, sometimes in great abundance. The refuge provides habitat for reptiles, including northern water snakes, eastern garter snakes, painted and spotted turtles.

More than 265,000 annual visitors from all over the world came to the refuge to enjoy the "Big Six," hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

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A. HIGHLIGHTS

Rachel Carson and Parker River National Wildlife Refuges were chosen as models of good land management. The two refuges joined together to compete for the new Land Management Research and Demonstration site program (LMRD) and placed first nationally.

Personnel changes are always very important on the refuge; people are how we get the work done. The refuge's ranks changed as follows this year:

Diane Corbin	Administrative Assistant	Resigned: Sept 21
Shannon Gurney	Forestry Technician	Transferred: March 10
Bob Harris	Wildland Urban Interface Coordinator	EOD: June 2
Kate O'Brien	Wildlife Biologist	Promoted GS-11: Sept 22
Robin Stanley	Forestry Technician	EOD: June 2

Diane is working for the State Department with plans to go to Guatemala this year. Buena Suerte! Shannon went to the fire program at Sheldon-Hart NWR.

For the first time since the 1980's, the refuge hosted a Youth Conservation Corps program this summer. Five enrollees and a group leader built trail, painted, mowed, pulled invasive plants, and learned about the our refuge's operations.

After years of planning and two years of contract delays, the refuge has a radio system! All vehicles have mobile units, the base station is operational, and there are an adequate number of hand-held units.

The Wells National Estuarine Research Reserve's Coastal Ecology Center opened in September. ORP Bloomfield served on the exhibits task force, attended innumerable meetings and contributed to exhibit theme and text. The Center and its exhibits are locally popular, professionally important and expand the region's scientific capacity.

The Trust for Public Land and the refuge purchased the largest and best remaining upland, salt marsh and productive mud flat habitat at Biddeford Pool in December.

Wetland restoration work at the six acre Biddeford Pool site was suspended due to inadequate funds. The work will continue next year.

Refuge staff attempted to provide environmental education to local school children at the ca.1784 Dyer house on the Biddeford Pool Division; however, the planning board rejected this conditional use in the coastal residential zone.

B. CLIMATIC CONDITIONS

The refuge is located along the southern coast of Maine and so weather conditions are moderated by the proximity of the ocean. Weather data is obtained from the FWS-11 Fire Weather Station

located at the refuge headquarters in Wells. Normal data is based on NWS observations at the Portland, ME Jetport 1961-1990.

Table B-1 below summarizes 2002 temperatures (degrees Fahrenheit) and precipitation (inches) for the refuge.

TABLE B-1

	Temperatures		Rainfall		Snowfall	
Month	**Maximum**	**Minimum**	**Normal**	**2002**	**Normal**	**2002**
January	52	11	3.53	2.74	19.2	15.8
February*	43	0	3.33	1.26	16.5	1.1
March	56	18	3.67	1.64	11.6	10.4
April	94	26	4.08	3.83	3.4	2.0
May	79	29	3.62	4.40	0.1	trace
June	89	36	3.44	6.13	-----	-----
July	94	46	3.09	2.38	-----	-----
August	91	51	2.87	1.74	-----	-----
September	88	39	3.09	4.07	-----	trace
October	80	23	3.90	4.19	0.4	4.0
November	63	11	5.17	4.37	3.1	3.2
December	50	4	4.55	3.67	13.6	17.4
TOTAL			44.34	38.37	71.3	53.9

* Incomplete

C. LAND ACQUISITION

The Service has been attempting to protect the largest remaining tract at Biddeford Pool for five years. We have appraised the land three times, worked with friends to raise private funds, drafted conservation easements and made several offers to purchase. We were saddened when a private party paid the owner's asking price two years ago. This year, The Trust for Public Land approached the new owner and, after considerable negotiation, was able to reach a price agreement. The refuge purchased 50 acres of excellent habitat on Biddeford Pool, one of the best birding sites in southern Maine.

1. Fee Title

The refuge received $1,000,000 for land acquisition in FY2002 from the Land and Water Conservation Fund. The following tracts were acquired:

Tract 100052, a, b	Young - Moody Division	2.96 acres	$10,500
Tract 11007c	Houston - Moody Division	2.39 "	$290,000
Tract 457	St. Hilaire - Goose Rocks Division	0.04 "	$4,000

Tract 737	Dean - Biddeford Pool Division	50.62 "	$1,250,000
Tract 2114	D&G Land Assoc. - Upper Wells	8.64 "	$140,000
Tract 1014	Brooks - Moody Division	1.85 "	$3,000
Tract	Domine - Goose Rocks Division	0.46 "	$95,000
Tract	Domine - Goose Rocks Division	1.00 "	$202,000

According to the Regional Office Realty Division, the refuge was approximately 5,142.51 acres in size by year's end. That is approximately 68 percent of the 7,500 acre approved acquisition boundary.

2. Easements

The refuge administers one FmHA easement, the 80 acre Gillespie Farm in North Yarmouth.

3. Other

The Preliminary Project Proposal, approved in 1999, was resurrected in the latter part of the year as an agreement on how to proceed was finally reached. Efforts to prepare a Land Protection Plan began with a contract to obtain ownership information and tax maps. A refined boundary has been drawn and maps were being prepared by the end of the year. Hopefully 2003 not only will be a year to celebrate the National Wildlife Refuge System Centennial but also the completion and approval of an LPP (and Comprehensive Conservation Plan) and have a new approved acquisition boundary.

D. PLANNING

1. Comprehensive Conservation Plan (CCP)

Year five of the planning process. In 2002, the planning team reviewed a new round of work required for completing the station's CCP. ORP Bloomfield substantially revised Chapter 2 (Alternatives) and its associated matrix based on new format directives from the Regional Office. During this editing process, team members realized that the five-alternative matrix could be pared down to just four alternatives. ORP Bloomfield, RM Feurt and DRM Taylor made changes to the matrix and folded relevant components of Alternative E (Open Management) into the remaining alternatives. Our work continues.

2. Management Plans

During the year, the fire crew continued re-writing the station Fire Management Plan, which was almost complete by year's end.

The annual Prescribed Burn Plan for Rachel Carson and Great Bay NWRs was completed and approved. A copy of the 2001 burn plan prepared for Pease/northern blazing star was submitted

to the state of New Hampshire in late October as requested. The state is planning to have landowners accept liability for prescribed burns for this rare, fire-evolved species. The state has asked Great Bay NWR to conduct the burn but the state will not accept liability.

The annual Hunt Program for the 2002-2003 season was completed and approved in April and an amendment was completed and approved in November regarding the Wells Sanctuary hunt.

4. Compliance with Environmental and Cultural Resource Mandates

In conjunction with the US Army Corps of Engineers and permit requirements for salt marsh restoration projects at the Mousam River and Little River (Kennebunk) sites, Regional Archaeologist Victoria Jacobson conducted a site visit in May. The purpose was to inspect ditches proposed for plugging for historic and prehistoric features as required by the State Historic Preservation Officer (SHPO). Nothing was observed during the inspection but a previously unknown (to the SHPO) dike was "discovered" adjacent to the Little River in Kennebunk.

5. Research and Investigations

Salt Marsh Restoration Monitoring

In 2001, USGS began a multi-refuge research project to examine the effects of ditch plugging. This work built on the original research conducted by Dr. Charles Roman (USGS-BRD, URI) and Dr. Susan Adamowicz (URI) who monitored salt marsh restoration sites at three locations on the refuge. Dr. Roman continued this work throughout a portion of 2002 and then left the project to take a new position with the National Park Service. The multi-refuge project is being continued by Dr. Mike Erwin (USGS-BRD).

Initial results of the project specific to Rachel Carson National Wildlife Refuge were summarized by Dr. Adamowicz and Dr. Roman in the document "Initial Ecosystem Response of Salt Marshes to Ditch Plugging and Pool Creation: Experiments at Rachel Carson National Wildlife Refuge (Maine)." Preliminary results were presented and a long-term monitoring schedule was determined. The document emphasized that due to the experimental nature of this restoration technique, it is critical that monitoring and evaluation continue for the next decade.

In 2002, staff sampled fish, SETS and vegetation at Granite Point and Moody salt marshes. We also continued OMWM bird surveys at Granite Point.

A new restoration site off Hills Beach Road on the Biddeford Pool Division was begun in December of 2001. Work was halted in February of 2002 due to lack of funds. Despite the fact that half of the ditches remain to be plugged, we continued to gather salinity and hydrological information. This marsh consists of a small area with 17 ditches of varying depths.

Point Count Landbird Study

The Goosefare Brook and Spurwink land bird routes were surveyed once by George Gavutis for the third consecutive year. WB O'Brien conducted an analysis of data collected to date and wrote a report documenting the Partners in Flight priority species identified.

Sharp-tailed Sparrow Research

Greg Shriver finished his doctoral research on sharp-tailed sparrows in 2002 and took a permanent position with the National Park Service in Vermont. Major findings from his dissertation work include: nesting chronology in relation to lunar tides, hybridization, range expansions, differences in nest success for the two species, and the accumulation of mercury in the blood of sharp-tailed sparrows. Mercury results were reported in "Mercury Exposure Profile for Sharp-tailed Sparrows Breeding in Coastal Maine Salt Marshes," in Biodiversity Research Institute 2002-11. Salt marsh sparrows in Maine have extremely high levels of mercury in their blood. Of particular interest was the finding that salt marsh sparrows carry almost twice as much mercury in their blood than Nelson's sparrows. Differences in mercury loading between sites were also detected. Sparrows at Popham Beach and at Ogunquit had the highest levels of mercury in their blood, while York, Scarborough and Weskeag had lower levels. The refuge continues to seek funding to support additional work on mercury contamination in Maine salt marshes. At this time this project remains unfunded. Dr. Shriver has been contracted by Regional Biologist Janith Taylor to analyze five years of point count data we have collected on salt marsh sparrows at the refuge. He is finishing the analysis. He will provide any population trends that are evident and estimate of the number of survey years necessary to detect statistically significant trends.

New England Cottontail

Dr. John Litvaitis continued work on the Ecoteam funded project "Assessing the Status of New England Cottontail and Identifying Areas for Habitat Enhancement for lands at Rachel Carson National Wildlife Refuge." Field work was delayed by poor winter tracking conditions in 2002 and a lack of an amendment to the cooperative agreement between USFWS and UNH. The amendment was signed in August, allowing for the use of allocated monies. In 2002, we held a joint meeting with Paul Dest of the Wells National Estuarine Research Reserve to discuss opportunities to cooperatively manage for New England cottontail. We purchased true color aerial photographs to support habitat mapping needs for this project. In September, a grant was drafted for the USGS Science Support Partnership. In February of 2003, we learned it was not funded.

Community Dynamics of the Biocontrol Agent *Galerucella*

Dr. Amy Arnett, a professor at Unity College, concluded her research on the community dynamics of areas that have had the biocontrol agents *Galerucella sps.* and *Hylobius sps.* introduced for the control of purple loosestrife. Her work in 2000 and 2001 indicated there was no relationship between the amount of herbivory a plant sustained and the fitness (measured by seed pod production) of the plant. However, she hypothesized that the number of flowers produced per plant or root ball size may have decreased. Dr. Arnett is currently seeking field sites closer to her university and is unlikely to return to Rachel Carson NWR lands.

Invertebrate Life History in Spurwink River

Professor Michael Mazurkiewicz from the University of Southern Maine continued to study invertebrate life histories at the Spurwink salt marsh.

Grassland Breeding Bird/Prescribed Fire Study

Rachel Carson NWR completed the second of a three-year USGS study examining the impact of prescribed burning on grassland nesting birds. This was an important study to participate in due to our interest in early successional habitat. None of our current holdings met the field size criteria (30+ acres). The refuge paired up with The Nature Conservancy (TNC) and used the Kennebunk Plains site for the study. This year, contract botanist Joann Hoy, volunteer Nancy McReel and refuge staff collected extensive vegetation data in June and August. Double observer point count surveys were conducted by biological technician Nancy Williams and contract birder Scott Crowenworth.

Malformed Frog Study

Dr. Kim Babbitt of the University of New Hampshire sampled the Brown Street impoundment and Fernald Brook for deformed frogs. Possibly due to habitat changes at Fernald Brook during several repeated droughts, an adequate sample of metamorphs were not able to be collected. Brown Street impoundment also did not contain an adequate sample of metamorphs for analysis.

New England Wild Flower Society/Maine Plant Conservation Volunteers

For the second year, ORP Bloomfield and WB O'Brien participated in the Maine Plant Conservation Volunteer program sponsored by the New England Wild Flower Society. With the assistance of volunteer Nancy McReel, the effort focused on checking on the status of many older Natural Areas records. The Drakes Island marsh was re-checked for occurrence of blue flag (*Iris prismatica*) and no plants were found. The area off of Oxcart Lane was surveyed for beach plum (*Prunus maritima*) and approximately 350 individual plants were found. Off-refuge plant populations surveyed included: Webhannet Woods in Wells for northern blazing star (*Liatris scariosa*), where the plant was not found. Ridge Road Pond in York was surveyed for featherfoil (*Hottonia inflata*), where a large population persists. Crescent Surf Beach was surveyed for seabeach sedge (*Carex silicea*) and many plants were found.

Wells Harbor Dredge Impact Study

John Lortie and Steve Walker of Woodlot Alternatives continue to monitor salt marsh accretion and/or erosion related to Wells Harbor dredging activities and salt marsh restoration.

Deer Tick Study

A special use permit was given to Dr. Rand and Charles Lubelczyk from the Maine Medical Center to conduct research on deer ticks, habitat correlations and Lyme disease at the Brave Boat Harbor Division. Three grids in three different habitat types were set up for small mammal trapping. Mammals were trapped using Sherman traps, tagged and immediately released. A total of 441 trap nights were recorded. *Peromyscus leucopus / maniculatus* (white footed or deer mice), *Clethrionomys gapperi* (boreal red-backed vole), *Tamias striatus* (eastern chipmunk),

Glaucomys volans (southern flying squirrel), and *Blarina brevicauda* (short-tailed shrew) were detected. *I. dammini and Dermacentor variablis* ticks were collected and were analyzed for Lyme disease infection rates. Infection rates ranged from 25-50%, depending on the area sampled.

Fire Management Options for Controlling Woody Invasive Plants in the Northeastern and Mid-Atlantic United States

Dr. Alison Dibble and Catherine Rees completed their second year of a regional, three-year investigation examining invasive species' flammability, distribution and effects on fuel loading. There was not any additional field work completed in 2002, however analysis of previously collected data continued. A preliminary report submitted in February indicated two trends: the graminoid layer tends to be more abundant in invaded stands and a shallower humus layer is present in invaded areas. These findings could effect fire behavior. Products from this work will include a model predicting invasibility of forests, fuel-loading estimates in invaded stands and a better understanding of how invasive species may affect fire behavior.

Assessment of Factors Endangering the Least Tern in Maine and Development of Management Strategies

University of Maine graduate student Jordan Perkins and her advisor, Dr. Fred Servello completed the first year of a two year study documenting limiting factors and identifying management actions for least terns in Maine. The study objectives include documenting productivity and nesting ecology, determining limiting factors for nest success and fledging rates, examining historic habitat factors and tern occupancy rates, conducting a population analysis to evaluate least tern management strategies, and providing management recommendations. (See G. Wildlife, 2. Endangered and/or Threatened Species (least tern section) for 2002 results.)

Effects of Tidal Restrictions on Fish Use of Salt Marshes in Southern Maine

University of New Hampshire graduate student Alyson Eberhadt completed her first year of fish sampling at Drake's Island marsh and at four other sites. Initial data suggests tidally restricted marshes impair movement of fish and, that given unrestricted access, *F. heteroclitus* expresses some site fidelity.

Understanding Shifting Wetland Community Organization and Diversity along Salinity Gradients: the Roles of Physical Stress and Competition

Brown University graduate student Caitlin Mullan completed her second of three years of field work at the Branch Brook marsh. Her research attempts to document forces driving plant community diversity and vigor.

Northeast Amphibian Research and Monitoring Initiative: Vernal Pool Study

This is the second year the refuge has participated in Dr. Robin Jung's USGS study. The refuge was given a small amount of money to implement the project and WB O'Brien and ORP Bloomfield completed the field work. The protocol was changed to identify four focal pools and run 250 meter transacts from two of these pools to document additional vernal pool habitat. Focal

pools were located off Short Farm Road in Kittery, Brown Street in Kennebunk, Route 9 in Biddeford and near Branch Brook in Kennebunk. Spotted salamander and wood frog egg masses were identified in all focal pools except for the pool off Route 9 in Biddeford. The Biddeford pool only had wood frog egg masses. Pools were surveyed a total of four times in the spring.

Least Tern Genetics Study
USGS researcher Dr. Susan Haig requested least tern tissue samples from dead birds and inviable eggs for her range-wide least tern genetics study.

Developing Methods for Identifying Suitable Donors for Wetland Plant Restoration Through Transplantation
USGS researcher Steven Travis submitted a proposal to identify *Spartina alterniflora* genotypes suitable for restoration. The refuge collected several specimens and sent them to his lab for analysis.

Wells National Estuarine Research Reserve Research:
The Wells National Estuarine Research Reserve (WNERR) overlays portions of the refuge's Upper Wells Division and the entirety of the Lower Wells Division. The following is a synopsis of investigations performed on refuge property by WNERR staff and visiting researchers this year:

Title: Estuarine Water Resource Quality
Summary: Water quality is monitored continuously at several stations with automated instruments as part of a National Estuarine Research Reserve system-wide monitoring program, as well as bimonthly at 15-20 stations through our WET volunteer monitoring program. The WET program also monitors two important biological parameters: fecal coliform bacterial contamination (an indicator of human health risk) and phytoplankton productivity (an indicator of estuarine health). These data have (1) allowed researchers to identify several bacterial "hot spots" that will be targeted for elimination, (2) identified areas safe for shell fishing, and (3) uncovered a relation between tides and low dissolved oxygen (a stressful condition for marine life) that needs further study. Water quality work has contributed to the designation of several "Priority Watersheds" in coastal Southern Maine by the Maine Department of Environmental Protection.

Title: Coastal Conservation Strategies
Summary: The Coastal Mosaic Project is a new program developed in response to requests for support from the conservation community to increase the quantity, quality and ecological integrity of conserved lands in our region. Research staff organize and facilitate meetings, workshops, and communications for 18 partner conservation groups. A key element of the project is the Conservation Resource Center, a reserve-staffed GIS facility with a growing database able to provide maps of property, natural features and other data needed to develop

effective conservation goals and strategies. The project is nearing completion of conservation land maps for 13 Southern Maine coastal towns, and is undertaking an initiative to develop coastal watershed conservation strategies for 12 coastal watersheds within these towns. The reserve has a particular interest in educating communities about the ecologic and economic benefits of land conservation, especially along estuarine and riverine shorelines.

Title: Salt Marsh Habitats and Communities
Summary: Factors that control the dynamics and vigor of salt marsh plant communities and marsh peat formation consequently determine the ability of a salt marsh to persist in the face of sea level rise. Through a combination of experimental manipulations and long term monitoring, a number of multi-year studies are currently producing data to answer questions concerning the sustainability of salt marsh habitats in this region. These studies are looking at nutrient-plant relations, plant community responses to physical and hydrologic disturbance, and the relative contribution of short-term natural events (e.g., storms) and human activities (dredging, tidal restriction) on patterns of sediment accretion and erosion. The reserve's marshes and beaches are already among the best studied sites in the U.S. with regard to long term accretion and erosion.

Title: Habitat Value for Fish, Shellfish and Birds
Summary: Long-term monitoring with periodic surveys and short-term experiments are identifying species and measuring trends and changes in populations of fish, crustaceans, clams and birds. The reserve has 10 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and eight years of wading bird data that researchers use as a gross-level indicator of salt marsh "health," which appears to be stable. Periodic larval, juvenile and adult fish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. In the coming year, the reserve plans to develop a long-term monitoring program for finfish that will be coordinated with other sites within the Gulf of Maine and along the East Coast. Since 1994, WNERR has been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clams with regard to habitat characteristics and predation by the invasive green crab.

Title: Salt Marsh Degradation and Restoration
Summary: Salt marsh ecosystems in the Gulf of Maine have sustained themselves in the face of sea-level rise and other natural disturbances for nearly five thousand years. Since colonial times, large areas of salt marsh (up to half of the total area) have been lost through diking, draining and filling. Today, the remaining marshland is fairly well protected from outright destruction but during the past 100 years, and especially since the 1950's, salt marshes have been divided into fragments by roads, causeways, culverts, and tide gates. Most of these fragments have severely restricted tidal flow, leading to chronic habitat degradation and greatly reduced access for fish and other marine species. Since 1991, the WNERR has been studying the impact of these restrictions on salt marsh functions and values, and the response of salt marshes to tidal restoration. Researchers have been working to promote an awareness of the damage being done and the benefits of salt marsh restoration throughout the Gulf of Maine.

Title: The Ecology of Northern New England Forb Panne Communities
Investigators: Patrick Ewanchuk, Mark Bertness; Brown University
Summary: Completed final year of data collection on numerous, experimental plots that looked at plant interactions influenced by tidal inundation and soil drainage. Findings submitted for publication and are currently in review.

Title: Integration of Individual Behavior and Community Dynamics to Determine Mechanisms by which the Invasive Green Crab, *Carcinus Maenus*, Impacts Populations of Native Soft-shell Clam, *Mya Arenaris*
Investigators: Lindsay Whitlow, Brian Hazlett; University of Michigan
Summary: Completed Ph.D. dissertation in 2002. Researchers looked at predator-prey interactions between different size classes of clams and crabs. They are preparing results for publication.

Title: Habitat Use by the Green Crab along the U.S. Atlantic Shoreline
Investigators: Paul Jivoff; Smithsonian Environmental Research Center
Summary: Conducted monthly trapping (six traps by three sites) of green crabs during June through September. All crabs collected, measured, sexed and returned. Ten crabs per sample day were frozen for dissection. No update for 2002 is available.

Title: Causes and Consequences of Plant Species Diversity in a New England High Salt Marsh
Investigators: Theresa Theodose; University of Southern Maine
Summary: Continued monthly monitoring of long-term plant plots and measurement of species-specific nitrogen availability and uptake, and nitrogen fixation. No update for 2002 is available.

Title: Application of a Continuous Imaging Flow Cytometer for Monitoring Estuarine Microplankton
Investigators: Christian Sieracki, Michael Sieracki; Bigelow Laboratory for Ocean Sciences
Summary: Continued phytoplankton and protozoan monitoring using flow cam deployed at Webhannet Harbor. Replaced original flow cam with miniaturized version. Refined wireless Internet transfer of plankton images to WNERR and to the world wide web. Researchers continued troubleshooting flow cam maintenance problems. No 2002 update is available.

Title: Estuarine Responses to Dredging: Analysis of Sedimentary and Morphological Change in a Back Barrier Marsh to Aid Local Management and Develop a Regional Management Tool
Investigators: Michele Dionne, David Burdick, Larry Ward, Duncan FitzGerald, Mark Rits; WNERR, University of New Hampshire, Boston University
Summary: Completed fourth year of monitoring of marsh accretion and erosion variables, including suspended sediment, sediment deposition, sediment accretion, marsh elevation change, channel profile change, inlet wave heights and currents. Project progress reports available at: http://ciceet.unh.edu

Title: Ecological Processes, Energy Pathways, and the Impact of Human Activities on Maine Marsh-Estuarine Secondary Production: A Salt Marsh Panne Model
Investigators: Richard MacKenzie, Michele Dionne; WNERR
Summary: Nine random pannes on the Webhannet marsh surface were the focus of this study. Researchers attempted to determine where fish found in pannes were feeding during high tide. Three enclosure treatments were established in June that restricted fish to pannes during high tide (panne only), allowed fish access to a known area of vegetated marsh surrounding the pannes (panne and marsh), or allowed fish to access the entire marsh (control – no enclosure). Pannes were visited once a month from June through August and sampled for fish and invertebrates. Fish were sampled using a 1 m^2 throw trap, identified, measured to the nearest mm, weighed to the nearest mg, and returned to the respective panne. Benthic macro-invertebrates were sampled from the pannes using a kick net. Samples were returned to the lab where invertebrates were sorted from the samples and then identified to the lowest practical taxon, measured to the nearest mm, dried at 60° C, and weighed to the nearest mg. Measurements of fish and invertebrates will be used in the future to determine secondary production in the different panne treatments. Projects results have been presented in seminars at University of New Hampshire, University of Maine and Gulf of Maine Aquarium.

Title: Estuarine Benthic Habitat and Sediment Profile Mapping
Investigators: Richard MacKenzie, Michele Dionne, Robert Diaz, Linda Iocca, Pace Wilbur; WNERR, Virginia Institute of Marine Sciences, NOAA Coastal Services Center
Summary: During September, researchers mapped the bottoms of the Webhannet River Estuary and the York River Estuary. A Sediment Profile Imager (SPI) camera was used at nearly 200 randomly created stations in both systems. This device is a specially designed instrument that can take photographs of the sediment profile. It allowed researchers to: 1) document bottom substrate type, 2) document benthic macro-invertebrate community structure, and 3) document various physical parameters occurring in the sediments at that station. Bottom type and invertebrate community structure were verified at 50 to 100 of the 200 stations using a modified Van Veen benthic grab. No 2002 update available.

Title: Temporal and Spatial Patterns of Insect Emergence in New England High Marsh
Investigator: Richard MacKenzie; WNERR
Summary: Specially designed emerging insect traps were placed in salt marsh pannes, brackish water pannes, and the marsh surface of the Little River salt marsh. Once a week from May until October in 2001, traps were changed and returned to the lab. Insects collected in the traps were killed via freezing and then identified to the lowest practical taxon (usually species). This work will increase our understanding of the spatial and temporal distribution of insects that utilize the salt marsh as habitat. Data currently being analyzed.

Title: Working with Communities to Track and Reduce Microbial Sources of Clam Flat Contamination from Local and Watershed Inputs
Investigators: Caitlin Mullan, Michele Dionne, Andrea Leonard, Stephen Jones; WNERR, University of New Hampshire
Summary: Researchers collected additional, unknown water samples for DNA fingerprinting to

determine vertebrate sources of *E. coli*. Interpretation of the DNA data is now in progress at UNH. Investigators produced a final report and descriptive Power Point presentation of the project.

Title: Microbial Source Tracking in Two Southern Maine Watersheds
Investigators: Fred Dillon, Cayce Dalton, Kristen Whiting-Grant, Michele Dionne, Stephen Jones; WNERR, University of New Hampshire
Summary: Adapted two fecal coliform measurement techniques to allow simultaneous measurement of both total fecal coliform, and *Eschericia coli*. Investigators conducted regular watershed sampling with trained volunteers and used microbiological procedures to isolate *E. coli* for genetic analysis at the University of New Hampshire. The samples are now being processed.

Title: Branch Brook, Merriland River, and Little River Watershed Survey
Investigators: Andrea Leonard, Cathy Walker; WNERR
Summary: Organized and trained volunteers for watershed survey; completed survey. Now organizing data for report. No 2002 update available.

Title: Water Quality Monitoring
Investigators: Scott Orringer, Andrea Leonard, Cathy Walker; WNERR
Summary: Maintained six water quality data loggers, collected data, reviewed year 2000 data for posting on the NERRS CDMO website. Data included in system-wide synthesis publication. Installed new weather station probes and conducted extensive trouble-shooting. Continued to download data for future correction and interpretation. Conducted bimonthly water sampling and analysis with student and citizen volunteers. Data summarized in new issue of WET Newsletter. No 2002 update available.

6. Other

DRM Taylor was selected as the R5 representative to the steering committee for the National Wildlife Refuge System Centennial Conference in November, 2003. The committee met five times throughout the year at the national FWS office in Arlington, VA and held conference calls every month. Steering committee members also served as liaisons to day teams which were established to plan each of the four days of the conference. DRM Taylor was liaison to the Day 2 and Day 4 teams and attended a meeting of each team (Day 2 in Atlanta and Day 4 in Olympia, WA) and participated in their conference calls as well. The planning effort has been very productive. The steering committee will continue to meet and hold conference calls during 2003.

WB O'Brien served on the Maine State Interagency Task Force on Invasive Aquatic Plants and Nuisance Species's Technical Subcommittee. She attended meetings and provided commentary for the State of Maine's "Action Plan for Managing Invasive Aquatic Species," which was published in 2002.

E. ADMINISTRATION

1. Personnel

1. Ward Feurt, Project Leader, GS-13, PFT, EOD 09/18/95
2. Graham W. Taylor, Deputy Refuge Manager, GS-12, PFT, EOD 06/24/93
3. Susan A. Bloomfield, Outdoor Recreation Planner, GS-11, PFT, EOD 09/14/97
4. Diane Corbin, Administrative Assistant, GS-7, PFT, 01/29/00, resigned 09/21/02
5. David Melvin, Maintenance Worker, WG-7, PFT, EOD 6/18/00
6. Kate O'Brien, Wildlife Biologist, GS-11, PFT, EOD 9/10/00
7. Mark Kerr, Forestry Technician, GS-6, CS, EOD 4/7/01
8. Shannon Gurney, Forestry Technician, GS-4, CS, EOD 9/23/01, resigned 3/10/02
9. Robin Stanley, Forestry Technician, GS-4, CS, EOD 06/02/02
10. Nancy Williams, Biological Technician, GS-5, TFT, 4/29/02-8/23/02
11. Lucy Coulthard, Biological Technician, GS-5, TFT, 5/20/02-8/23/02
12. Aaron Germaine, YCC Group Leader, GS-5, TFT, 06/17/02-8/23/02
13. Laura Breed, YCC Enrollee
14. Paul Burtchell, YCC Enrollee
15. Eric Gilman, YCC Enrollee
16. Elizabeth Quinn, YCC Enrollee
17. Elaine Proper, YCC Enrollee
18. Kate Ostergren, Summer Intern

Clockwise from back left row: Graham Taylor, (Invasive Plant Contractor) Deborah Kendall, Ward Feurt, David Melvin, Robin Stanley, Kate O'Brien, Diane Corbin, Susan Bloomfield, and Kate Ostergren.

This year brought some more staff changes and promotions at the refuge. Shannon Gurney resigned the forestry technician position and took another position with FWS in Region 1. Robin Stanley was selected to fill the vacant GS-4 forestry technician position and has been a welcome addition to the staff.

Diane Corbin resigned in September to take a position with the State Department. Diane was one of the best office assistants we've ever worked with (for) and will be greatly missed. Many of the staff have learned to do their own travel vouchers, and the DRM and RM appear to be doing okay in making sure both staff and bills get paid. We are also receiving able assistance from Parker River and Great Meadows NWRs, as well as the RO. Although we advertised for a

replacement administrative assistant in September, fiscal constraints prevented us from filling the position through the first quarter of FY-2003.

During the year, biologist Kate O'Brien was promoted to her full performance level at GS-11. Kate continues to keep the biological program humming and managed to attend the Refuge Academy in late October at NCTC.

Once again, funding was received through a challenge grant for working on piping plover and least tern monitoring in southern Maine. Lucy Coulthard was hired in May after our initial selection reported for duty two weeks late due to car troubles and resigned within a few hours of being selected for a different job elsewhere.

Nancy Williams was hired back for her second season as a biological technician. Nancy was very familiar with the position after her first year and was responsible for conducting marsh and wading bird, grassland bird and sharp-tailed sparrow surveys. Nancy used to work for BLM in California as a wildlife biologist and was of great assistance to us.

Deputy Manager Taylor completed the R5 Leadership Pathway training that began in November 2001 and ended in November of this year.

Forestry technician Mark Kerr attended Refuge Officer Basic School at NCTC in May. Mark is a collateral duty officer when not performing fire duties.

Bob Harris, one of the Regional Office's Wildland Urban Interface Coordinators, joined us in June. Bob came to us from the US Forest Service in Tennessee.

2. Youth Programs

This was the first time in many years that Rachel Carson NWR hosted the Youth Conservation Corps. The enrollee and staff consensus was that it was a positive learning and work experience. The group was lead by Aaron Germana, a Kennebunk High School teacher. The enrollees were: Elizabeth Quinn from Lyman, Eric Gillman from Sanford, Sam Burtchell from Biddeford, and Laura Breed and Elaine Proper from South Berwick. The eight-week program ran from July 1 to August 23.

On their first day, the group was oriented to the refuge, met the staff, completed the American Red Cross first aid course, and started work on the group's primary project, the Brave Boat Harbor Trail. With guidance from FT Kerr, the group blocked off finger trails and trimmed overgrown branches and brush. Later in the summer, they built six walkways over wet areas and erected two sections of post and beam fence at the end of the trail to keep people off the marsh.

They were busy with other projects, as well: cleaning up around the RHC headquarters; building a stone dust path between the headquarters and our shop; tearing down the metal storage shed; building its replacement; fixing handrails on the Carson trail; helping FTs Kerr and Stanley post

newly acquired property in the Spurwink Division; mowing and weed whacking at the headquarters, Granite Point and Dyer House properties; replacing broken fencing behind the shop and residence; keeping ahead of litter; and helping FT Kerr confiscate a canoe off of the Bridle Trail. The crew also removed piping plover exclosures with Biological Technician Lucy Burnell on two beaches. At Great Bay NWR, the crew spent a week painting restrooms, and moving equipment boxes from one bunker to another.

During the course of the summer, the crew became well versed in several aspects of natural resource management. Enrollees pulled buckthorn from around the headquarters; the activity served as an opportunity for WB O'Brien to introduce the group to the topic of invasive species. Further afield, the crew spent one morning at the Wells National Estuarine Research Reserve watching a bird banding demonstration. Biological Technician Lucy Burnell escorted the group to the Regional Office in Hadley, MA to learn more about the USFWS.

Aaron and the crew worked very hard and we appreciated the work they accomplished.

4. Intern/Volunteer Program

Intern Program

Lauren Cormier joined the staff as our 12-week, Environmental Education/Natural Resource Management intern this summer. She was a sophomore at the University of Vermont. Lauren replaced two sides of our Carson Trail visitor information kiosk with new interpretive materials, researched and presented two weekly interpretive program to visitors, independently staffed our visitor contact station from 10:00 a.m. - 2:00 p.m. on weekends, and drafted a pesticide fact sheet. She also maintained and monitored songbird nest boxes throughout the refuge, conducted biweekly shorebird surveys, managed our *Galerucella* beetle distribution project to control purple loosestrife, and assisted refuge staff with piping plover and invasive species monitoring. She received college credit for her internship.

Kate Ostergren was our salt marsh intern. She started as a refuge volunteer in the early spring. She is a recent graduate of Grinnell College and came to us with a good botanical background. Kate worked primarily with the refuge biologist to collect hydrological, vegetative and fish data in support of a regional USGS study examining the impact of salt marsh restoration activities. Her primary duties included independently collecting hydrological data and water chemistry parameters. She assisted with invasive species GPS mapping and vegetative sampling. Kate created a invasive species identification binder specific to the refuge. She also assisted with piping plover/least tern management, prepared and cataloged herbarium samples, controlled purple loosestrife, and surveyed shorebirds.

Tammy Tuminelli, a University of New England student, worked on an educators survey for the Dyer House project. She also contributed to YCC recruitment and bluebird nest box maintenance.

In addition to overseeing all aspects of the internship program, ORP Bloomfield periodically updated and shared the station's college/university address database used for national recruitment. This year yielded only one error out of 130+ mailings.

Volunteer Program:

Volunteers contributed 2,434 hours to the refuge by assisting staff with a variety of surveys this year, including those for least terns, piping plovers, rare plants, anurans, waterfowl, and shorebirds.

ORP/Volunteer Coordinator Bloomfield compiled, edited and updated the "Volunteer Opportunities" list for the station and sent "Volunteer York County!" updates whenever needed. She sent wildlife-related, volunteer announcements to the York County Audubon Society and Maine Audubon for their newsletters. Coding on the volunteer hours form was changed to more closely match the RCAR activity report. Volunteers were sought by producing periodic press releases, leaflets and cable channel announcements. All potential volunteers were provided with complete recruitment packages.

Volunteers Michael Gendell and Clair Ganter helped spruce up the refuge on York County's "Day of Caring."

The refuge again participated the United Way "Day of Caring" community volunteering project on June 6. ORP Bloomfield supervised three volunteers from Paquin and Carroll, an insurance company in Biddeford, who cleared out our drainage ditch at the end of the road, swept accumulated debris from the entrance road, and scrubbed down our picnic tables.

5. Funding

The regional, final budget distribution was available on March 26, 2002, although the draft advice arrived on December 17, 2001. In 2002, refuge funding was as follows:

1262 Maintenance $ 23.0K	9263 Fire $ 65.4 K	1261 Operations $398.9K

The biological program was the beneficiary of most of our additional funding. We successfully competed for $12,500 for piping plover and least terns, $15,000 for wetland restoration and $4,145 for New England cottontail status assessment from the Gulf of Maine Ecosystem team. We also received habitat funds: $2,800 for an anuran study, $12,960 for standardized bird surveys, and $9,500 for the on-going open marsh water management (OMWM) study. We received an additional $1,500 for a regional fire/grassland bird survey. We hired contractors with

$2,210 for invasive species identification, location and mapping. In the miscellaneous category, the fishing event was funded at the level of $1,000, and we received $1,500 for a contractor to list all the maps and lots in the proposed land protection plan.

Funding History at Rachel Carson NWR			
2002	$488,800	1993	$121,609
2001	478,500	1992	26,930
2000	527,600	1991	125,000
1999	368,900	1990	171,000
1998	415,800	1989	139,122
1997	316,100	1988	123,117
1996	330,990	1987	142,493
1995	183,221	1986	69,735
1994	172,745	1985	N/A

Maintenance funds were again inadequate to meet the station's needs. Repair costs on machinery, especially the dump truck and Posi-track, were responsible for over-runs. Gulf of Maine Office and refuge cooperator SWAMP, Inc. contributed $2,500 each to offset repair costs. The refuge was funded $132,000 to rehabilitate the Dyer house. This funding was inadequate to cover costs for the lowest of eight bidders, and the project was withdrawn. All but $841 dollars of the funds were returned to the Region's maintenance management account. The refuge replaced the Posi-track with the new $84,009 model. GSA sold the old machine to SWAMP, Inc. for $16,553.

The Service did not recommend Land and Water Conservation Funding for Rachel Carson NWR for the FY2003 budget. Friends of Rachel Carson NWR and the Trust for Public Land worked diligently to secure a $3 million mark in the Senate. The House of Representatives, despite the good works of District 1 Congressman Tom Allen, was silent on land acquisition at the refuge. Congress did not pass a budget in 2002, at year's end the continuing resolutions extended until January 11, 2003.

The Station Base Fund amounts are based on Complexity Levels established in 1997. Due to the many station changes in four years, the old method of computing Station Base Funds is no longer adequate. Refuge Manager Ward Feurt had the task of convening a group to recommend an equitable distribution plan. Refuge Managers Mark Sweeney, John Schroer, Pat Martinkovic, Sue Rice and Paul Casey developed the following plan for FY2003 distributions:

1. $10,000.00 as base funding for each headquarters station
2. $2,000.00 as base funding for each staffed satellite station
3. $2,250.00 per FTE

4. Budget increases are prorated to the FTE allowance, not the base funds
5. Budget decreases are prorated from the base funding (the $10,000); we suggest not going below the $2,250/FTE, if possible.

6. Safety

The refuge established a more formal safety committee this year. Members of the committee include DRM Taylor, MW Melvin, FT Kerr and OA Corbin. The group met and outlined safety topics for the latter part of the year. Topics covered included heat stroke/exhaustion, defensive driving training, lifting and falls, and an SOP for visitor injuries or accidents.

Several accident reports were generated during the year. The office assistant hurt her back moving the copy machine and was out for two days in early March. The YCC leader missed two days of work because of a spider bite. Most of the other reports were for tick bites.

8. Other Items

Our station web page got up and running this year, thanks primarily to (R5 web representative) Ron Rothschadl's late April launching of http://rachelcarson.fws.gov/ to commemorate the anniversary of Silent Spring. Later in the year, ORP Bloomfield initiated an effort to get the Carson Trail brochure linked to the site via www.nctc.fws.gov/library/refuges. We now have links to the station's general brochure, trail guide and bird list on our web site.

Volunteer Jay Arbelo took information from our general brochure and formatted it on several web pages for eventual merging with the existing web page. We are currently awaiting the arrival of Dreamweaver, our web page management software, purchased as part of a bulk Interior order.

The refuge will host the Maine Junior Duck Stamp Competition in 2003 and possibly through 2005. DRM Taylor will assume the role as the state coordinator for the program with the 2003 contest, which began in November of this year. Aroostook NWR previously held the competition but due to limited staff and time, found it increasingly difficult to host.

F. HABITAT MANAGEMENT

1. General

Habitats found on Rachel Carson NWR are quite diverse. Coastal salt marsh is at its northern limits in southern Maine. Rachel Carson NWR and the Scarborough Marsh State Wildlife Management Area encompass approximately 85% of all salt marsh habitat in the state. The rocky coast typical of Maine is also present and interspersed with sandy shores and barrier beach islands. Forested uplands consist primarily of young stands of mixed hardwood and softwood species. Grasslands, pitch pine back dunes, freshwater wetlands, tidal creeks, and shrublands comprise the remainder of the habitats.

Rachel Carson and Parker River National Wildlife Refuges joined together to compete for a place in the new Land Management Research and Demonstration program (LMRD). This nationwide effort, based on the *Fulfilling the Promise* document, establishes a demonstration area program within the National Wildlife Refuge System for testing, teaching, publishing, and demonstrating state-of-the-art management. Rachel Carson and Parker River refuges focused on salt marsh management and restoration.

The LMRD program has the following five goals.

1. Demonstrate land management techniques designed to provide healthy habitats for fish, wildlife and plants.
2. Research, test and develop land management techniques.
3. Communicate information on featured habitats and associated management techniques to appropriate audiences.
4. Integrate career/staff development opportunities into Land Management Research and Demonstration program.
5. Evaluate and maintain the Land Management Research and Demonstration program.

Some 230 refuges were included in the request for proposals. The proposals were reviewed by a federal and non-government panel of experts. The joint project submitted by Rachel Carson and Parker River refuges ranked first in the nation. Eight LMRD sites are planned for funding in FY2003, with seven more funded in 2004. The 13 sites are:

Refuge	Featured Habitat
1. Rachel Carson/Parker River	Coastal salt marsh
2. Hanford Reach	Shrub steppe
3. Bosque del Apache	Managed wetlands
4. St Marks / Carolina Sandhills	Longleaf pine
5. White River/Cache River/ Bald Knob	bottomland hardwoods
6. Northern Great Plains refuges	Tall & mixed grass prairie, DNC
7. Tetlin	Boreal forests
8. Neal Smith	Tall grass prairie & savanna
9. Lake Umbagog, Nulhegan Basin, Moosehorn, Sunkhaze Meadows	Northern hardwood forest
10. Balcones Canyonlands	Juniper-oak woodlands, live oak motts, remnant tall grass prairie
11. Kauai	Tropical wetlands
12. Fergus Falls WMD	Prairie wetland complex
13. Alaska Maritime	Island ecosystems

A new project to map and quantify the extent and composition of invasive plants on the refuge began this year. This project was supported with funding from Regional Biologist Janith Taylor. Contract botanist Joann Hoy, contractor Deborah Kendall and intern Kate Ostergren collected the field data. Deborah Kendall completed the GIS work with the assistance of Regional GIS

Coordinator Rick Schauffler. The field work for Brave Boat Harbor, Goosefare Brook and Mousam River was completed. Field data for portions of Lower Wells and the majority of Upper Wells was collected. GIS work has been completed for Brave Boat Harbor, Mousam River and Goosefare Brook. If funding is continued, this project will be completed in 2003.

Kiddie pools with netted purple loosestrife plants. Each plant supports Garucella beetles for eventual release.

2. Wetlands

Tidal salt marsh constitutes the majority of wetlands occurring on RHC. Applications were submitted for three restoration projects in 2001: Biddeford Pool, Mousam River (1, 2 and 3) and the Little River. The U.S. Army Corps of Engineers required that the Mousam River and Little River projects have public review. These permits were still pending at the end of this year. The Biddeford Pool project was permitted by the Corps and work began in December, 2001. Due to lack of funding, this project had to be halted in February, 2002 before restoration was complete. Eight out of seventeen ditch plugs were installed. NAWCA and centennial grants were submitted to fund completion of the project in 2003. These grant applications are still pending.

We continued to collect data at Moody Point and Granite Point to support the USGS study that focuses on the impact of ditch plugging on salt marsh hydrology, vegetation and wildlife use. In 2002, a salt marsh restoration interpretive sign was installed at Granite Point marsh.

Several stems of *Phragmites* were removed from alongside the Merriland River. All purple loosestrife plants (approximately 10) were also removed from this area.

We continued our community-based purple loosestrife biological control program despite our lack of funding for the spring season. We ordered 2000 adult *Galerucella* beetles and reared them on 110 plants. Beetles were released by the Saco Conservation Commission, Kennebunk Conservation Commission, Beach Plum Farm, Great Works Land Trust, Kennebunk Conservation Trust, Cape Elizabeth Conservation Commission, Kittery Land Trust, and York Conservation Commission. Beetles were also released on the refuge in Wells and on the Spurwink River. We reared over 50,000 beetles for release. We have been contacted by several landowners in Maine for information on how to propagate beetles for use in their own communities. Partners were enthusiastic and we successfully competed for a grant from the National Fish and Wildlife Foundation to support the work in 2002 and 2003.

Galerucella beetles at the Wells and Spurwink release sites continue to overwinter and feed on purple loosestrife. Plants at the original release site at the Spurwink have been decimated but loosestrife plants adjacent to that area are still growing. The Wells release site shows significant damage, yet plants still persist.

3. Forests

Forested uplands comprise approximately 25 percent of the total acreage of the refuge at this time. The forested areas are primarily of the oak-hemlock-white pine community typical of southwest, coastal Maine.

The invasive species, glossy buckthorn, was hand pulled from two areas on the refuge. Staff worked to hand pull many trees just outside of our headquarters. The Youth Conservation Crew pulled many trees out of the Brave Boat Harbor Division. Complete removal was not achieved and there remains much work to be done.

5. Grasslands

A vegetation monitoring protocol was adopted using the guidelines provided in the USGS Grasslands Study. WB O'Brien created maps and selected random vegetation sampling points. Forestry technicians with minimal assistance of the Biologist and botanist Joann Hoy completed pre-burn monitoring plots at the following burn units: Cutts 1, Hosmer, Moody west, Houston, Taylor, and Libby west. Our tractor was broken; no mowing was done this year.

6. Other Habitats

Rachel Carson National Wildlife Refuge has three beaches that support piping plovers, one of which also supports least terns. The piping plover is a federally threatened species and both the piping plover and least tern are listed as endangered under the Maine Endangered Species Act.

In 1998, Crescent Surf Beach underwent drastic alterations with most of the southern portion of the beach bisected and all vegetation washed away. By the spring of 1999, conditions along the southern half of the beach improved and provided good plover and tern nesting habitat. Conditions for plover and tern nesting continued to improve in 2000, with expanses of moderately vegetated, sandy areas increasing. In 2001, staff noted an increase in vegetation along the spit and a decrease in sand around the far arm. In 2002, the spit increased in length, but was narrower at the tip. Sand built up along the arm of the beach in mid-summer and vegetative cover increased in density.

In 2002, the refuge began to identify shrublands amenable for management for New England cottontail and other shrubland species.

9. Fire Management

Robin Stanley was selected in June to fill the GS-4 position vacated by Shannon Gurney who

accepted a fire position in Region 1. Mark Kerr attended and completed S-390 and Prescribed Fire Planning and Implementation (PFPI). Robin Stanley attended and completed S-130/190, S-211, S-216 and S-290. Robin also completed Farm Tractor Training at Moosehorn NWR. All staff successfully completed the pack test and annual fire training in April at Rachel Carson NWR.

Several communities with refuge lands have been identified as communities at risk in the federal fire plan. Refuge staff in cooperation with the Maine Forest Service contacted local fire departments about grants through the Rural Fire Assistance Program. We know of four towns that submitted applications; two were funded in 2002. Kennebunkport received $6,026 and Kittery received $2,160. Funding was for a backpack foam tank, pump, hose, foam, some small tools, and PPE.

This year was the fourth, consecutive year with below-normal precipitation and the fifth with above average temperatures. Consequently, the area was in a drought condition early on that limited prescribed burning. The refuge also had a self-imposed closed window for burning from July 15 to August 30 to allow for the nesting of ground birds. Last year's efforts in discussions with State Forest Fire officials paid off when we sought burning permits from local municipalities. We were able to obtain permits for several burns and successfully complete them. Seven burns covering approximately 22 acres were conducted during the months of May, June, September and October at the refuge. A prescribed burn was also conducted in October at Great Bay NWR.

For wildland fire support in the West, FT Stanley participated on two crews and FT Kerr on one crew.

The refuge has a cooperative agreement with The Nature Conservancy to assist each other in both wildland and prescribed fire within the area. This year, there was again a 100% reciprocity for the burns that were conducted. Refuge staff assisted at all Nature Conservancy burns and Conservancy staff were present at all refuge burns, including those at Great Bay NWR. Refuge staff assisted The Nature Conservancy burn a total of 100 acres on three units on the Kennebunk Plains and attempt a unit at the Beach Plum Farm.

The FTS weather station was upgraded in the fall and now has satellite download capabilities. The weather station will be moved to a new location in 2003 to improve satellite communication. It is a better site for obtaining actual weather conditions.

When not engaged in prescribed fire operations, career seasonal forestry technicians accomplished the following: posted fire management unit boundaries; conducted hazardous fuel inventories; established and monitored vegetation plots in burn units; and inventoried, checked, maintained and repaired fire equipment at both Rachel Carson and Great Bay refuges. FT Kerr also assisted with rewriting the Fire Management Plan for the station and the 2002 Annual Burn Plan. The technicians also began developing an interpretive brochure on prescribed fire.

The refuge was selected to host one of the regional field Wildland Urban Interface Coordinator positions. Bob Harris was selected to fill the position; he arrived in June. Bob was previously a forester with the US Forest Service in eastern Tennessee. In preparation for Bob's arrival, the office addition begun in 2001 was completed to a move-in condition by June with the trim and heat finished during the remainder of the year.

The refuge submitted several FirePro requests for the FY2004 fire budget.

The Prescribed Burn Plans for the Rachel Carson and Great Bay NWRs were completed and approved.

G. WILDLIFE

1. Wildlife Diversity

A wide variety of species can be found due to the diversity of habitats both on and adjacent to the refuge. Over 350 species of birds, mammals, reptiles, amphibians, and fish are present, some at the limits of their ranges. Interesting sightings in 2002 include: right whales off of the coast of York in December, up to eighteen roseate terns staging and loafing at Crescent Surf Beach in July, an ermine living in the Rust House, and a probable four-toed salamander in a bog in Upper Wells.

2. Endangered and/or Threatened Species

The Maine Endangered Species Act's species listing is subject to review every five years. This list was enacted in 1997. Due to staffing constraints at the Department of Inland Fisheries and Wildlife, a revision in 2003 is unlikely.

Several mussels, mayflies, dragonflies, butterflies and moths are listed under Maine's Endangered Species Act. It is unknown if any of these occur on the refuge. Mark Ward, a contract biologist for the State of Maine contacted the refuge in May to request permission to survey sphagnum bog habitat for the ringed boghaunter, a state endangered dragonfly. Two refuge sites were surveyed and were marginal habitat for this species. However, off refuge, the large sphagnum bog adjacent to the Boston and Maine Railroad in Kennebunk received a rating of 3, which is the highest rating for habitat potential. An ebony boghaunter, a species of special concern in Maine, was observed at this wetland.

The Department of Inland Fisheries and Wildlife maintains a list of special concern species. This list is administrative and has no legal standing. Several of these species occur on refuge lands; New England cottontail is one of them. In 2000, a coalition of groups petitioned the federal government for the species to be listed under the Endangered Species Act. In 2003, FWS will determine if this species warrants federal listing. Refuge staff continue to document New England cottontail sightings and is supporting research targeting New England cottontail management (see research section).

Bald eagles are seen every winter in the Biddeford/Saco area feeding along the Saco River. Dams maintain open water and provide feeding areas for the birds.

Below is a current list of Maine's endangered and threatened mammal and bird species that occur, or may occur, on the refuge:

Species	*Status*
Golden Eagle - Aquila chrysaetos	*Endangered*
Peregrine Falcon - Falco peregrinus	*Endangered*
Piping Plover - Charadrius melodius **	*Endangered*
Roseate Tern - Sterna dougallii *	*Endangered*
Least Tern - Sterna antillarum	*Endangered*
Black Tern - Chlidonias niger	*Endangered*
Sedge Wren - Cistothorus platensis	*Endangered*
Grasshopper Sparrow - Ammodramus savannarum	*Endangered*
Bald Eagle - Haliaeetus leucocephalus **	*Threatened*
Harlequin Duck - Histrionicus histrionicus	*Threatened*
Arctic Tern - Sterna paradisea	*Threatened*
Upland Sandpiper - Bartramia longicauda	*Threatened*
Box Turtle - Terrapene carolina	*Endangered*
Black Racer - Clouber constrictor	*Endangered*
Blanding's Turtle - Emydoidea blandingii	*Endangered*
Spotted Turtle - Clemmys guttata	*Threatened*

* *Federally listed Endangered Species*
** *Federally listed Threatened Species*

Piping Plovers

Since 2000, the refuge has taken primary responsibility for monitoring several sites on and off refuge lands. The refuge monitored Crescent Surf, Laudholm, Parson's, Marshall Point, Goosefare Brook, and Ferry Beach. The refuge also shared responsibility with the Maine Audubon Society for monitoring Old Orchard Beach and assisted on Wells and Ogunquit beaches. A total of 13 nesting pairs, with 11 successful nests, produced 36 chicks. Lucy (Coulthard) Burnell was our plover technician for 2002.

Five pairs, initiating five nesting attempts, laid eggs at Crescent Surf in 2002. A total of 19 eggs were laid, of which 9 hatched, with 6 fledging. Symbolic fencing was erected in early April. All nests except one were within the fenced area. Predation rates were higher on Crescent Surf this year. Early in the season crows combed the beaches and were seen partially predating one unexclosed nest. Two of the five nests were completely destroyed. One nest was washed over during a storm on June 15 and another unexclosed nest near an embankment was predated on June 30. Productivity for this beach was 1.2 fledglings per pair. Productivity was low due to small clutch size, a storm event, predation, and the fact that plover pairs did not renest. Piping plovers were not found nesting at Marshall Point; however, plovers were occasionally seen loafing in the area. Dog tracks and human footprints were seen in the area. The house adjacent to this beach was sold again. Hopefully the new owners will have better control over any pets.

A pair of plovers nested near the mouth of Goosefare Brook. The refuge acquired a significant portion of the beach habitat in the area and the TNC holds the remainder, pending a transfer of

that land to the refuge. In 2002, a larger area was fenced off and posted for the protection of the plovers. One pair produced four eggs, four of which hatched, and one chick reached maturity and fledged. One of the chicks was found dead within the symbolic fencing and was sent to Madison Wildlife Health Lab for analysis. No obvious trauma was documented, however little food was found in the gullet. Given the cold and wet weather during the previous days, it is likely that weather contributed, if not caused, the death of the chicks. Pedestrian and unleashed dog trespass in the nesting area remains a significant problem at this site. In 2002, on 27 different occasions, people were found inside the symbolic fencing. Increased public outreach and enforcement of posted areas should improve the success of this site.

Off-refuge, we took primary responsibility for pairs nesting at Laudholm Beach. Five pairs, initiating six nesting attempts, laid eggs at Laudholm Beach in 2002. A total of 19 eggs were laid, of which 16 hatched, with 15 fledging. Laudholm Beach had a productivity of 3.0 fledglings per nesting pair. Although illegal dog-walking occurs on the beach, plover productivity remained high.

The refuge worked with private landowners on Parson's Beach to protect the 3 pairs (1 was a renest) that nested there. Landowners with plover habitat were contacted early in the year to request permission to manage plovers on their lands. All landowners except two granted permission. Symbolic fencing was erected early on the Alling's property in an attempt to make it more hospitable to plovers. One pair nested near their path and another pair nested at the northern tip of Parson's Beach on the Dwight's property. Another pair renested late in the season, began incubating two eggs, and later abandoned their nest. The landowner on whose property this pair nested refused to grant permission for an exclosure. This pair's productivity was factored into Crescent Surf numbers. A total of 11 eggs were laid by three pairs. Seven eggs hatched and all chicks fledged.

Year	Total # Pairs	# Pairs Nested	# Nests	# Chicks	# Fledged
2002	5	5	5	9	6
2001	5	5	5	15	14
2000	3	3	2	7	7
1999	4	4	4	10	4
1998	3	3	5	14	6
1997	4	4	4	18	13
1996	5	5	5	18	15
1995	4	4	8	10	9
1994	4	4	4	15	11
1993	4	4	4	16	16

Nesting success of piping plovers at Crescent Surf Beach for the last 10 years

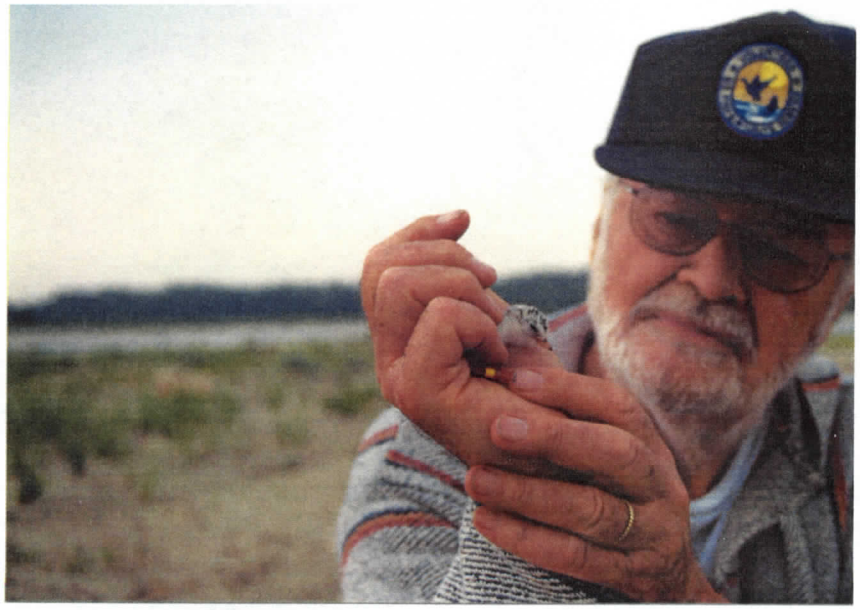
The refuge also had primary responsibility for weekly searches for piping plover activity at Ferry Beach. There was no nesting activity this year.

In 2002, Maine had an estimated 65 pairs of nesting plovers that produced 88 fledglings. Annually, refuge lands support approximately 10 percent of the nesting plover pairs in Maine. When off-refuge land management activities are added in, Rachel Carson NWR provided 20 percent of nesting piping plovers in Maine and produced 33 percent of the fledglings in Maine.

Refuge staff surveyed Laudholm, Crescent Surf, Parson's, Marshall Point, Goosefare Brook and Ferry Beach during the International Piping Plover Census in June.

Least Terns

Least terns are listed as an endangered species by the State of Maine and as a PIF priority species for Area 9. Crescent Surf Beach supported the largest least tern nesting colony in the state and produced the largest number of fledglings. Crescent Surf Beach produced 165 nests from a minimum of 106 pair and Laudholm Beach produced 29 nests from a minimum of 12 pair. Nest numbers include renests. In 2002 at Laudholm, 38% of nests were predated, 28% were lost to storm tides, 0% were abandoned and 27% were successful. At Crescent Surf, 1% of nests were predated, 30% were lost to storm tides, 5% were abandoned and 61% were successful. Productivity for Crescent Surf Beach is estimated to be 1.25 chicks per pair.



Volunteer Donald Currie with a least tern hatchling.

University of Maine graduate student Jordan Perkins began her thesis work to document limiting factors for least terns in Maine. She banded 103 chicks at Crescent Surf and Laudholm Beach. She counted nests, chicks and fledglings. She compared two methods for estimating numbers of pairs, high nest counts and also counting incubating terns and adding in nests that had already hatched. The latter method gave a higher estimate.

Refuge staff again attempted to estimate least tern fledglings during dusk surveys. On August 6, we estimated a minimum of 38 fledglings. However, we know that estimate is much lower than actual fledgling production measured by Jordan Perkins (see table below). Likely factors affecting the colony are: storm events, predators, disturbance from people and animals, and possibly food limitations (this aspect has not been explored).

Least Tern Production: 2002				
Beach	**High Nest Count**	**Estimated Pairs**	**Chicks**	**Est. Fledglings**
Laudholm	12	12	15	10
C. Surf	81	106	193	133
Higgins	9	14	23	8
Reid State	3	0	0	0
Reid ½ mile	16	25	25	2
Total	**121**	**157**	**256**	**153**

	PIPING PLOVER			LEAST TERN		
YEAR	Crescent Surf	Laudholm	Statewide	Crescent Surf	Laudholm	Statewide
2002	5(6)	5(15)	65(88)	106(134)	12(10)	157(153)
2001	5(14)	4(14)	55(109)	102(50)	15(7)	120(63)
2000	3(7)	6(14)	50(80)	85(62)*	37(17)*	126(81)*
1999	4(4)	4(11)	56(91)	40(45)	20(20)	62(67)
1998	3(6)	2(3)	60(88)	22(7)	0(0)	86(12)
1997	4(12)	1(2)	47(93)	18(1)	0(0)	50(11)
1996	5(14)	1(4)	60 (98)	16(0)	0(0)	60(30)
1995	4(9)	1(2)	40(95)	25(9)	8(0)	100(16)
1994	4(11)	1(3)	35(70)	35(32)	12(13)	89(79)
1993	4(16)	1(4)	32(76)	64(62)	1(3)	125(114)
1992	4(16)	1(0)	24(49)	15(42)	14(11)	94(123)
1991	3(9)	1(3)	18(45)	0	1(1)	52(25)

Number of nesting pairs and fledglings ( ) of piping plovers and least terns at Crescent Surf Beach, Laudholm Beach and statewide for the last twelve years. Estimates for 2002 are preliminary results from U. Maine graduate student Jordan Perkins. They are based on estimation of incubating pairs added to pairs which have already hatched chicks. Fledgling numbers are based on number of hatched chicks multiplied by survivorship from banding study.

** Approximate number of fledglings; numbers adjusted from 2000 Maine Audubon Final Report*

Roseate Terns

Up to eighteen roseate terns were seen loafing at the tip of Crescent Surf Beach in June. One dead, banded, adult tern was found and sent to the National Wildlife Health Center for analysis. The tern was in excellent body condition and may have drowned during a storm on June 14. This bird was banded in 1990 on Bird Island in Massachusetts.

3. Waterfowl

The refuge provides habitat for breeding, migrating and wintering waterfowl. Breeding populations are small and include Canada geese, American black duck, mallard, wood duck, teal and common eider. Common eider broods can be regularly observed in summer on Biddeford Pool, Goose Rocks and Goosefare Brook Divisions. Small populations of migratory waterfowl include pintail, American widgeon and ring-necked ducks. Offshore, migratory species include three species of scoters, common eiders, red-breasted mergansers, and long-tailed ducks. The majority of use during the year is from wintering waterfowl. American black ducks are the most common wintering species and, with open water, can be found on every marsh and river. Groups of common eider, common goldeneye, bufflehead, common loons, long-tailed duck, and red-breasted merganser can be found in river mouths and in the waterways of salt marshes.

On November 25, we conducted aerial surveys of the entire refuge. Aerials scheduled for December and January were canceled due to budget shortfalls. In addition to Rachel Carson NWR, York River, Saco River, Scarborough Marsh, and Parker River NWR were surveyed. WB O'Brien and FWS pilot John Bidwell (out of Old Town, ME) conducted surveys. Biologist Nancy Pau (Parker River NWR) traveled with us and started training as a second observer. Data is summarized by pilot John Bidwell and is sent out as both ".dbf files" and ArcView shape files. All data were entered into Excel and CENSUS for analysis.

On January 3, the state conducted the midwinter inventory and flew the entire coastline. The refuge lies within Unit 8, which is further broken down into subunits. The table below summarizes selected species found in Unit 8:

Species Total	Mallard	Black	Common Goldeneye	Bufflehead	Long-tailed Duck	All Scoters	Common Eiders	Mer-gansers	Canada Geese
2002	880	2665	221	224	341	116	6626	958	529
2001	419	710	71	103	224	510	4477	126	567
2000	221	1014	117	77	301	850	5129	434	402

Common eider, American black duck, mallard and merganser were the most numerous species present. Also, of note were three mute swans, fourteen loons and one bald eagle. Total ducks observed was 12,668, up from 7,267 in 2001 and 11,199 in 1999. Midwinter waterfowl counts vary greatly depending on weather and ice conditions. Numbers are useful for interpretation over long time intervals.

Twenty waterfowl ground surveys and two waterfowl aerial surveys were conducted during the year. The data was entered into the CENSUS database.

4. Marsh and Water Birds

Eleven species are documented to occur on the refuge. Great blue heron, Virginia rail, snowy egret, great egret and green-backed herons account for the majority of use by this group. Less commonly observed species include little blue heron, American bittern, tricolored heron, black-crowned night heron, and glossy ibis. The refuge provides essential staging and feeding areas for these species. During the spring, summer and fall, these birds spend time feeding in the extensive creeks and salt pannes.

Nancy Williams returned to the refuge for a second year to conduct marsh and wading bird surveys following a standardized survey protocol. Seven routes were conducted throughout the refuge with a total of 51 points. Nine points were removed from the survey due to unsuitable habitat. All points were surveyed three times and consisted of playing a tape to elicit a response by the target species. The tape used was the interior habitat callback tape that had recordings of the following species: least bittern, sora, Virginia rail, yellow rail, common moorhen and pied-billed grebe.

The only primary species observed during the survey periods was Virginia rail, found at five locations. Rails were counted repeatedly at two locations near Marshall Point. The most common secondary species recorded were red-winged blackbirds and common yellowthroats. Some of the non-target species observed during the survey period included belted kingfishers, green-backed herons, snowy egrets, willow flycatchers, alder flycatchers, and great blue herons.

5. Shorebirds, Gulls, Terns and Allied Species

The refuge is used at various times of the year by up to 35 species of birds in this category. Greater and lesser yellowlegs, black-bellied plover, semipalmated plover, dowitcher, and least and semipalmated sandpiper are the most commonly observed shorebird species found on Rachel Carson NWR. Along with the common species, a great diversity of other shorebird species were recorded using the refuge including: whimbrel, willet, black-bellied plover, one American avocet, dowitcher and sanderling. Refuge salt marshes, mudflats and salt pannes provide habitat for nesting, feeding and staging for these species. Purple sandpiper, sanderling and dunlin winter along the Maine coast and can occasionally be found on the refuge during that time. Key areas of high shorebird use on the refuge include the Webhannet River mud flats adjacent to Oxcart Lane and Wells Harbor, the Little River mudflats on the Upper Wells Division, Crescent Surf Beach, and Sampson's Cove on the Goose Rocks Division.

Sixteen shorebird surveys were conducted during the year and the data entered into the refuge CENSUS database program. Shorebird populations generally peak in August, during fall migration. The refuge is also a stopover for shorebirds during spring migration. Some species, such as willet and killdeer are known to breed in salt marshes at Granite Point and in the Webhannet.

Gull species present throughout the year are primarily greater black-backed and herring gulls. Other species seen at various times of the year include ring-billed gull and Bonaparte's gull.

Common terns can be found throughout most of the refuge's divisions. Common terns stage for post breeding migration in great numbers (200+) at Crescent Surf Beach.

Staff conducted three out of seven woodcock survey routes. Biddeford, Upper Wells-Mousam River and Brave Boat Harbor routes were completed. No singing woodcock were detected on any of these routes. This was somewhat surprising as woodcock were heard singing at Great Bay NWR during the same time frame, and generally the Brave Boat Harbor and Upper Wells routes are productive.

Route	Average Woodcock / Route	Number of Survey Years
Brave Boat Harbor	2	4
Moody / Lower Wells	0.5	2
Upper Wells / Mousam	3.7	3
Goose Rocks	3	3
Little River	1.3	3
Biddeford	0.75	4
Spurwink	12	1

* Note: Spurwink not averaged; surveyed for only one year.

6. Raptors

Three species of raptors have been confirmed as breeding on the refuge: sharp-shinned hawk, Cooper's hawk and great horned owl. Northern goshawk, red-shouldered hawk, red-tailed hawk, broad-winged hawk, American kestrel, and barred owl are probable breeders. Other species present at various times include northern harriers, merlins, short-eared owls, northern saw-whet owls and snowy owls.

7. Other Migratory Birds

The refuge initiated grassland bird surveys using a standardized survey protocol in 1999 and continued the surveys in 2002. Forty-four points were established along six routes throughout the refuge and run twice between May and July. Survey routes were conducted at York River, Goosefare Brook, Goose Rocks, Spurwink River, Brave Boat Harbor, Upper Wells, and Moody

Divisions. Unlike 2001, bobolinks and eastern meadowlarks were the only target species observed. Upland sandpipers, vesper sparrows, field sparrows and grasshopper sparrows were not detected.

Breeding landbird routes on the Goosefare Brook and Spurwink River Divisions were continued for the third consecutive year. In 2002, these routes were surveyed once by contract biologist George Gavutis. Relative abundances (total of individuals of a species/total of individuals of all species detected) are included in parentheses. At Goosefare Brook, a total of 52 species and 357 individual birds were recorded. The most abundant species detected were ovenbird (9.52), American crow (9.52), black-throated green warbler (7.56), black-capped chickadee (5.88), American goldfinch (7.28), and red-eyed vireo (5.60). At Spurwink River, a total of 46 species and 182 individual birds were recorded. The most abundant species detected were American goldfinch (7.69), red-winged blackbird (7.69), blue jay (7.14), and mourning dove (5.49).

The refuge runs surveys for salt marsh sparrows at over 100 points. The survey was run for the third consecutive year in 2002. The table below summarizes the frequency of these species (points observed/total number of point*replicates) by division.

Division	Frequency Salt Marsh	Frequency Nelson's	Frequency Unk. STSP
Brave Boat Harbor	.06	.03	0
York River	.33	.60	.36
Moody	.53	.37	.42
Lower Wells	.45	.42	.41
Upper Wells	.66	.66	.66
Mousam	0	.06	0
Goose Rocks	.15	.15	.24
Little River	.66	.6	.53
Biddeford Pool	.28	.43	.24
Goosefare	.58	.91	.5
Spurwink	.40	.53	.37

The refuge maintains 30 nest boxes for eastern bluebirds. Tree swallows accounted for more than 50% of box use. Boxes were checked every few weeks throughout the summer by refuge staff, volunteers and interns. If chicks hatched, and the box was empty at the next visit, chicks were assumed to have fledged. Box 29 was removed due to repeated house sparrow nesting.

Boxes 13 and 15 have been targeted for removal in 2003 due to house sparrow use.

Fledgling estimates are not available as the boxes were not visited frequently enough and eggs were not always counted. Our intern was not tall enough to see into the boxes to count the eggs and she did not have a hand mirror to view the eggs until later in the season.

Species	Tree Swallow	Black-Capped Chickadee	House Sparrow	Eastern Bluebird	No Use
# Boxes Used	24	7	3	3	3

Summary of nest box use for 2002; some boxes were used multiple times

8. Game Mammals

White-tailed deer are common throughout the refuge. The Upper Wells Division contains the largest concentrations due to a state-designated wildlife sanctuary that overlays the area and generally precludes hunting. A special season was opened by permit only in 2002. Moose are being sighted more frequently on the refuge and can be seen on most of the divisions, particularly Upper Wells and Mousam River.

9. Marine Mammals

Several harbor seal haul-outs exist at the Brave Boat Harbor, Lower Wells, Mousam River, and Goose Rocks Divisions. The most frequently used site is the marsh near the Wells Harbor on the Lower Wells Division. As many as 25 seals can be observed here at various times of the year. In the winter season, harp, gray and harbor seals can occasionally be seen hauled out in refuge salt marshes.

Right whales were sighted off of the coast of York in December.

10. Other Resident Wildlife

More than 47 species of mammals (including marine mammals) have been reported on the refuge including beaver, river otter, ermine, porcupine, and fisher. For some species such as the pine vole, the only state records are from the refuge.

Refuge staff conducted anuran call count surveys in 2002. This year, Goose Rocks/Little River, Brave Boat Harbor, Spurwink and Wells/Kennebunk routes were run. Difficulty in meeting the temperature guidelines, combined with staffing constraints, prevented the survey from being repeated for all three times for all routes except Brave Boat Harbor and Little River/Goose Rocks. Wood frogs were heard calling around April 3. Timing surveys to catch their short calling period remains challenging. USGS sponsored research to document the relationship between vernal pools and habitat has discovered both wood frog and spotted salamander breeding in several places.

14. Scientific Collections

Three inviable piping plover eggs were delivered to Biodiversity, Inc. for mercury analysis. Four dead least tern chicks and 80 inviable least tern eggs were collected for a genetics study.

16. Marking and Banding

Waterfowl banding was not conducted this year. A meeting was held on August 27 with the Office of Migratory Birds, State waterfowl managers and refuges to discuss efforts to band American black ducks, mallards, resident geese and wood ducks. Due to the timing of migration at Rachel Carson NWR and the low density of birds occurring here, the refuge was not encouraged to start banding at this time. However, there was interest expressed for banding of resident geese on all refuges.

17. Disease Prevention and Control

West Nile Virus (WNV) continues to spread northward from New York into New England. In 2001, seven birds tested positive for WNV in Maine. This year a total of 71 birds had died and tested positive for WNV. In addition, one WNV-positive mosquito (*Oc. sollicitans*) pool had been identified in a salt marsh in Wells. Refuge staff will continue to be on the alert for sick or dead birds. In 2001, the Maine Department of Human Services established a toll free number (1-888-697-5846) to report them.

Lyme disease continues to be prevalent on refuge lands. Staff and volunteers are provided with information on how to protect themselves against it.

Chronic Wasting Disease (CWD) has yet to be reported in the state. In 2002, over 100 deer carcasses were tested by the Maine Department of Inland Fisheries and Wildlife.

H. PUBLIC USE

1. General

Over 265,000 people visited the refuge this year to enjoy trails, hunt deer and waterfowl, try their luck at fishing, learn about natural history, and appreciate our serene landscape. Visitors from 43 states and nine countries (Germany, Argentina, England, Costa Rica, Scotland, Ireland, Spain, Japan, and Canada) signed our register. In April, we added a basic Internet web page to our standard outreach methods. Even in its infancy, it was well received.

In an effort to attract more visitors to our summer interpretive programs, ORP Bloomfield contacted over 35 local innkeepers by e-mail to determine if they'd like visitor program information e-mailed or faxed to them. The response was enthusiastic. Consequently, throughout the summer, weekly announcements were sent out to hotels, motels and inns along with the standard list of chambers of commerce and libraries.

2. Outdoor Classrooms - Students

Field trips to the refuge by local school districts, day camps and scouting troops offered insights into marsh ecology, botany, geology and hydrology. Students from Wells, Kennebunk, Kennebunkport, Eliot, North Berwick, Biddeford, Sanford, and Limerick visited in the spring and fall, along with groups from New Hampshire (Exeter and Somersworth), and Massachusetts (Salem, Bedford, and Lexington). The Environmental School in Ocean Park, ME was again granted a special use permit to conduct salt marsh ecology classes on the Goosefare Brook Division.

After staff spent countless months readying for change, surveying local educators, drawing plans and attending public meetings, the Biddeford Planning Board voted 3-1 in mid-May to reject the refuge's effort to turn the refuge-owned Dyer House in Biddeford into an environmental education center. Public concerns regarding the choice of site, privacy of adjacent neighbors, noise, air pollution from idling buses, and road safety were cited as reasons for their decision. RM Feurt and ORP Bloomfield attended nearly every public meeting regarding the renovation plans for the house on Old Pool Road. RM Feurt held a refuge-sponsored, informational meeting on April 2 at the Hills Beach Fire Station that attracted nearly 80 people. After the Board's decision, RM Feurt, DRM Taylor and ORP Bloomfield met to determine the fate of the house. In an effort to regain the site for wildlife, they decided the best course would be to sell/convey the house with the condition that it be moved off the site entirely. In August, the Dyer House was put up for bid. (See I. Equipment and Facilities, 2. Rehabilitation)

6. Interpretive Exhibits/Demonstrations

A three-paneled exhibit entitled "She Wrote a Book That Changed the World" arrived at the refuge in the fall and was placed in the visitor contact area. Ron Rothschadl, R5 Public Affairs, designed it to commemorate the 40th anniversary of the publication of Rachel Carson's Silent Spring. We'll have it on long-term loan.

After many months of working on the WNERR's Coastal Ecology Center Exhibits Subcommittee, ORP Bloomfield completed her exhibit text review assignment. Exhibit installation occurred in the summer and the Reserve's Coastal Ecology Center opened with much fanfare in September.

On June 29, ORP Bloomfield and DRM Taylor presented a youth fly fishing event with refuge partner, the Kittery Trading Post, at their store. Ten youths, aged eight to fifteen, were taught how to fly fish by Kittery Trading Post master angler, Chris Hensen. He covered fly fishing basics, tackle and casting techniques. Later on, the children practiced casting on the grass with surprising accuracy. ORP Bloomfield coordinated the event with store managers, wrote press releases, offered introductions, and spoke about refuge fishing opportunities and the upcoming centennial. DRM discussed fishing laws and angler ethics. There were many adult onlookers and the event was deemed a success by Mr. Hensen, who volunteered to offer the program again in 2003.

7. Other Interpretive Programs

In January, ORP Bloomfield gave an evening program about the refuge's significance and projects to twenty Junior Girl Scouts at Saco Middle School.

On May 5, the refuge recognized International Migratory Bird Day with a bird walk along the Carson Trail. Twelve visitors attended the program, lead by OPR Bloomfield. Attendees were mostly beginner and intermediate birders; twenty species were recorded.

On May 7, ORP Bloomfield was a wildlife-section judge in the 2002 Southern Maine Regional Envirothon competition held at Harris Farm in Dayton, ME. The Envirothon, a national program, challenges students to learn about environmental issues and be tested on many aspects of resource conservation. Approximately 55 York County high school students participated in teams of three to five.

In June, the refuge made leaflets and brochures available at the WNERR's Earth Day Festival.

Refuge staff commemorated National Wildlife Refuge Week by holding a public "morning coffee" to discuss the significance of the System, our upcoming centennial and current refuge projects.

8. Hunting

The refuge is open for the following hunting seasons as set by the State of Maine: archery and firearm deer seasons, waterfowl (sea ducks only when concurrent with regular duck), and pheasant. The refuge also allows falconry during the special season (as set by the State) that usually runs through the end of February.

The refuge hunting permit and fee are based upon the species a hunter is interested in. For the first time since 1995, the number of hunters obtaining permits declined from 425 in 2001 to 403. One hundred eight (108) new hunters, 12 seniors with complimentary state licenses, and 46 youth hunters obtained permits. The table below shows the number of permits issued for each hunting category. Because a hunter could actually have a combination permit to hunt during different seasons i.e., deer and migratory bird, the actual number of permits/category is greater than 425. Hunters spent an estimated 2,750 days hunting on the refuge.

2002-2003 Hunting Season - Number of Permits Issued Per Category				
Deer	Migratory Birds	Pheasant	Falconry	Total
309	136	36	5	486
64%	28%	7%	1%	100%

The state implemented a youth deer hunting day on October 26 this year and again held a youth waterfowl day on September 21.

The Maine Department of Inland Fisheries and Wildlife (IF&W) contacted the refuge in August to obtain our support for a limited archery hunt in the Wells and Drakes Island Game Sanctuaries. These areas include lands that are part of the refuge that have been closed to hunting for over 60 years. IF&W has estimated up to 100 deer per square mile in that area, well above the desired levels. The refuge opened approximately 200 acres after amending the annual hunt plan. Hunters with 2002 deer hunting permits as of November 7 that had identified themselves as bow hunters were contacted about the special hunt. Interested hunters notified the refuge and 25 names were randomly drawn. The individuals selected then had to comply with additional state requirements including not having any previous hunting or fishing violations. Those complying with the requirements were notified of their selection to participate in the two week bow hunt from December 2 - December 14. Those participants could harvest three antlerless deer and keep one. The other deer were donated to Hunters for the Hungry. Hunters could obtain another permit allowing three more deer if they wished. Alternate hunters were selected and notified if a permittee decided to no longer hunt. Theoretically this allowed for a maximum number of hunters in the field. However, at times during the two week period, very few or no hunters were out. At the conclusion of the special hunt, 28 deer had been taken, mostly off refuge lands. It is expected that this special hunt will occur again in 2003.

9. Fishing

The refuge formally opened nine areas for fishing or fishing access in September 2000. Eight fishing areas have been designated on the Brave Boat Harbor, Moody, Lower Wells, Upper Wells, Mousam River, Goosefare Brook, and Spurwink River Divisions along with a car top launch site at Cutts Island on the Brave Boat Harbor Division. These areas are open for bank fishing primarily for sea run brown trout and striped bass during seasons set by the state of Maine. An estimated 300 anglers may be using these areas.

11. Wildlife Observation

The wildlife observation platform at Goosefare Brook was nearly completed this year. Parking lot signs were installed and visitors began using the structure. While landscapers worked to place contracted plants, staff noted obvious shortcuts forming between shrubs. Digital pictures were taken of these social trails leading from the walkway to the beach. Fine-tuning the landscaping component of the project will continue into 2003.

17. Law Enforcement (LE)

Rachel Carson NWR encompasses approximately 5,000 acres in 10 divisions and in FmHA easements along 60 miles of the southern Maine coast. This area of Maine receives approximately 7 million visitors a year, mostly during the summer months. Visitation is slowly expanding into early spring and late fall. The refuge currently has two collateral duty refuge officers, DRM Taylor and lead FT Kerr.

This year, types of violations were typical until September when there was a significant increase in the types of crimes occurring. The first known homicide on the refuge occurred in early September. A woman's body was found by a refuge bow hunter on the Goosefare Brook Division. Refuge Officer Kerr assisted local and state police as well as the Warden Service in conducting searches for the murder weapon, which was not found. An arrest was made within days after the Massachusetts resident confessed to local law enforcement. The subject was extradited to Maine and is currently being held without bail pending trial in early 2003.

Also during September, several car burglaries occurred at the parking lot for the Carson Trail. The reported incidents occurred once each weekend apparently in early afternoon. Unfortunately, only one was reported to the refuge. The others were reported to the Wells Police Department, which did not notify us. We were not aware that a rash of car clouts was occurring and did not establish surveillance of the parking area until October. No other incidents were reported or observed during the surveillance.

Refuge officers and staff continue to document other violations throughout the year and estimate that at least 500 violations occur on the refuge. Other violations that were reported to the refuge or evidence found included: vehicle trespass (4x4, various types of watercraft, ATV, snowmobile, bicycle), illegal parking, general trespass (foot, ski, horse, dogs), camping, dogs off leash/running deer, plant collecting/cutting vegetation, illegal hunting and fishing, target shooting, fires, dumping, and vandalism.

Incidents/violations have been entered into the LEIR program. The 2001 annual LE report for Rachel Carson NWR was completed in January.

Officer Kerr was sent to Washington D.C. in the spring as part of a team of refuge officers who provided security at the Main Interior Building. He received an award for his efforts.

DRM Taylor served on the R5 LE Committee for the 2002 refresher. DRM Taylor and FT Kerr attended LE refresher at NCTC in April. They also successfully qualified with their duty weapons in October at Fort Devens.

I. EQUIPMENT AND FACILITIES

1. New Construction

The new construction projects completed in 2002 included the garage conversion begun the year before as well as the addition to the headquarters building. The final stage of the garage

conversion was completed with the assistance of Kirk Cote from Aroostook NWR. His knowledge and experience allowed RHC to capitalize on an existing heating system expansion.

MW Melvin had been told on several occasions by qualified heating contractors that the existing system was either too old or too inefficient to expand. Given the current layout of the building and the fact that the construction would essentially increase the useable space by 50%, the solutions worked out by EO (Kirk) saved RHC a considerable amount of money by not having to replace the existing furnace. Creating a new zone to the system, re-routing pipes and installing pipe coverings created a system that would use a lower thermostat setting and achieve better results. In the opinion of MW Melvin, this type of solution is rarely used because of its complexity and unwillingness of the heating contractor to do the work. It has always been easier to remove an existing system and replace it with a new one. When one is trying to curtail spending, this is not always the best option.

The WUI addition to the headquarters was also completed this year. MW Melvin managed this project and oversaw the contributed work of many RHC staff members. The highly complicated process of bracing trusses was accomplished without a hitch. We were grateful for the help of MW Springfield, and EO Burke of Parker River NWR who lent a hand to MW Melvin and RM Taylor with drywalling. Their assistance was much appreciated. After completing the drywall and painting, MW Melvin installed a suspended ceiling in the two offices. (Suspended ceilings reduce heat loss by 50 percent compared with a ceiling of drywall. They also allow for correct placement of lighting fixtures, heating ducts, etc..) At all times during construction, MW Melvin assured that staff worked together safely.

The remaining new construction project involved removing the refuge's small, 8' x 10', metal kit shed and replacing it with a larger, more utilitarian structure. The new shed occupies the entire slab (144 ft^2 vs. 80 ft^2) and headroom clearance increased to 8' from 6'. The old shed was removed by the YCC crew. They learned about safe demolition and simple wall construction. During construction, the refuge fire crew honed their carpentry and painting skills.

From the various projects completed at RHC this year, one thing remained constant. Each project was completed with similar material so that the next project would be easier to accomplish. The wooden shed that replaced the metal shed was built with leftover materials from the shed demolition and WUI addition. The shed's door was salvaged from the garage conversion. The paint for the shed's exterior was left over from the original construction of the headquarters building. Yankee Ingenuity = cost-savings +wise use of resources.

2. Rehabilitation

In January, RM Feurt sent a letter to the Biddeford Planning Board requesting reutilization of an existing refuge structure, the Dyer House on Old Pool Road:

> The subject property is located at 59 Old Pool Road. The current residence has been vacant since 1992. The property owner, U. S. Fish and Wildlife Service, seeks to refurbish this circa 1784 cape for use as a residence. Additionally, we will use the

existing addition (built after 1900) as an environmental education site for school groups on a reservation basis.

The residence will maintain the current three-bedroom configuration. Approaches will be modified to be universally accessible and a restroom will be added to the back of the addition. A new leach field east of the house will replace the current cesspool. Richard A. Sweet submitted a site evaluation statement and states that the data reported are accurate and that the proposed system is in compliance with the State of Maine Subsurface Wastewater Disposal rules. The attached plans show details of that system.

A gravel parking area of approximately 40' x 120' (see drawing) will be sited on the adjacent lot which we purchased for that purpose. A waiver is requested for the location of the entrance to that lot as noted on the site plan review application. A stone dust trail will lead from the parking area to the house. The refuge plans to use the addition as a environmental education site for school groups. School groups will make arrangements with our headquarters to bring a class to the site at a designated time for a specific education activity. The addition area is large enough to accommodate a single class of school children as they prepare for the designated activity. U. S. Fish and Wildlife Service environmental education curricula will be delivered by qualified individuals, usually college students. Through a cooperative agreement, the chairman of the Environmental Science Department at the University of New England will provide college students to orient the school children to the site and lead interpretative walks. A loop dirt trail approximately 3/8 miles long will pass through three habitats as it winds towards the salt marsh and will provide opportunities to interpret the wildlife values of the area.

However, the project was rejected by the town of Biddeford in May. Refuge staff determined that the best course of action for the Dyer House was to sell/convey the house with the condition that it be moved off-site. The house, while not on the historic register, has archeologically interesting features such as unpainted siding; original, varnished cabinet doors; hardware; 24"+ pine flooring boards; etc.. A contract was let in October to sell the house. At year's end, the second story was removed, the addition divided from the main structure and the house cut in half. It will be refurbished at its new location, off-refuge, on the Ferry Beach Road in Saco.

We will rehabilitate the site by filling the cellar hole, foundation and cess pool; finishing with topsoil; and planting appropriate, native species. We will manage the property for disturbance-dependent species and maintain it as shrub-scrub habitat.

3. Major Maintenance

In any facility, maintenance is an ongoing battle. RHC is no different. We are, however, different in our philosophy. We strive to complete various jobs, keeping in mind the affect on wildlife, how we may optimize the lifespan of the project, and how the work will affect other areas of refuge operations.

Vehicle maintenance remains a top priority. Much of the spring was spent catching up on vehicle maintenance that is so important given the age of the fleet. The fire engine received attention. The ATV was repaired; it had a minor electrical problem that was expensive to correct.

The two seasonal residences were maintained. The clutter was removed from the two houses to provide simple, safe and secure housing to our seasonal employees.

ORP Bloomfield vacated the refuge headquarters residence in December. Plans to paint the walls, refurbish the floors and attend to basic repairs began at the end of the year.

4. Equipment Utilization and Replacement

The station backhoe received most of the use in equipment time. MW Melvin traveled to Nashua Fish Hatchery to dig a trench to run fiber optic cable to three buildings. He also returned in the fall to dig a trench for a sewer connection.

There were three vehicle manufacturer recalls. Two were safety-related items needing seat belt replacement clips. The third item was the Ford pick up, which was ordered with a larger radiator but came to the dealership with the smaller one. The error was caught by Ford, not the dealer. The larger radiator was installed at no charge.

Another of the many YCC projects involved the use of the backhoe to demolish a small building on refuge property. MW Melvin operated the backhoe and demolished the small shed. The YCC crew along with the fire crew loaded the destroyed building into a large roll-off dumpster. The area where the shed once stood has now for the most part recovered nicely.

5. Communications Systems

The radio system funded in FY 2001 was finally completed and installed at the end of 2002. The system includes a base station, repeater, mobile units for almost all vehicles and portables for all staff. The frequency utilized is shared with all the refuges in Maine and Great Bay NWR in New Hampshire. The process to purchase the radios in working with the Denver Communications Office was one of the worst experiences ever encountered. After receiving word of the funding in January of 2001, it took over 20 months to complete the entire installation process.

6. Computer Systems

All computers at the refuge office are networked together. Throughout the year the server at the office disconnected at least twice daily and had to be rebooted by staff. This has been a frustrating and time-consuming problem that is still unresolved. The problem probably lies within the server and not the provider as they have checked their equipment and lines.

A laptop was purchased that enabled us to access e-mail. Our older machines did not have that capability.

7. Energy Conservation

Given the importance of our mission at RHC and the fact that it is our responsibility to lead by example, we have chosen energy conservation to play a major role in any maintenance decision. We use methods and materials that by their very nature conserve energy. In our construction projects, we rarely use dumpsters. The large roll-off containers are cost-effective but they contribute too much to the waste stream. We used metal where we could and recycled the scraps. We returned anywhere from 1000 pounds to over a ton of material to a metal recycling facility. We used plastic to cover the insulation in the walls where faced insulation is more cost effective. (The plastic method is more energy-efficient and creates a tighter air infiltration barrier.) We recycled over a ton of paper products. Latex and vinyl products are kept to a minimum. We recycle 500 to 600 cans and bottles each year. Our use of hydrocarbons is consistent with recycling all that we can. We simply separate the waste and recycle whenever possible.

J. OTHER ITEMS

4. Credits

Narrative Prepared by:	Susan A. Bloomfield
Editing:	Susan A. Bloomfield
Highlights:	Ward Feurt
Climatic Conditions:	Graham Taylor
Land Acquisition:	Graham Taylor
Planning:	Susan A. Bloomfield, Graham Taylor, Kate O'Brien
Administration:	Graham Taylor, Susan A. Bloomfield, Ward Feurt
Habitat Management:	Kate O'Brien, Graham Taylor
Wildlife:	Kate O'Brien
Public Use:	Susan A. Bloomfield, Graham Taylor
Equipment and Facilities:	David Melvin, Graham Taylor, Ward Feurt

K. FEEDBACK

L. INFORMATION PACKET–Inside Back Cover

K. FEEDBACK

Budget constraints are binding everyone. At Rachel Carson NWR, we support the National Wildlife Refuge System and regional initiatives. This year, that support cost us dearly, and we do not expect to be able to provide the same level of support in FY 2003.

January 7-11	Arlington, VA	Centennial Conference Steering Committee
January 7-11	NCTC	Budget training
January 7-18	Pelican Is NWR, FL	Detail
January 25-28	Great Meadows NWR, MA	Strategic Habitat Workshop
Feb 24-March 1	NCTC	Supervisor Training
Feb 25-March 1	Suffolk, VA	Project Leaders Meeting
Feb 25-March 1`	Hadley, MA	Detail
March 6-7	Hadley, MA	Leadership Pathway Detail
March 24-28	NCTC	Administration Workshop (2 employees)
April 1-4	Arlington, VA	Centennial Conference Steering Committee
April 12-19	NCTC	LE Refresher (2 employees)
April 24-25	Long Island NWR, NY	Station Base Funds Committee
June 19-23	Arlington, VA	Centennial Conference Steering Committee
July 1-12	Prime Hook NWR, DE	Detail
August 26-28	Atlanta, GA	Centennial Conference Day 2 Meeting
September 3-6	Arlington, VA	Centennial Conference Day 4 Meeting
November 4-8	Auburn, NY	Project Leader / Wage Grade Meeting (3 employees)
November 12-14	Arlington, VA	Centennial Conference Steering Committee

Although some of these items are training, there were no special funding arrangements for any of these obligations. Our ability to accommodate support requests for the national wildlife refuge system would be significantly enhanced if we only had to juggle schedules and operational needs.